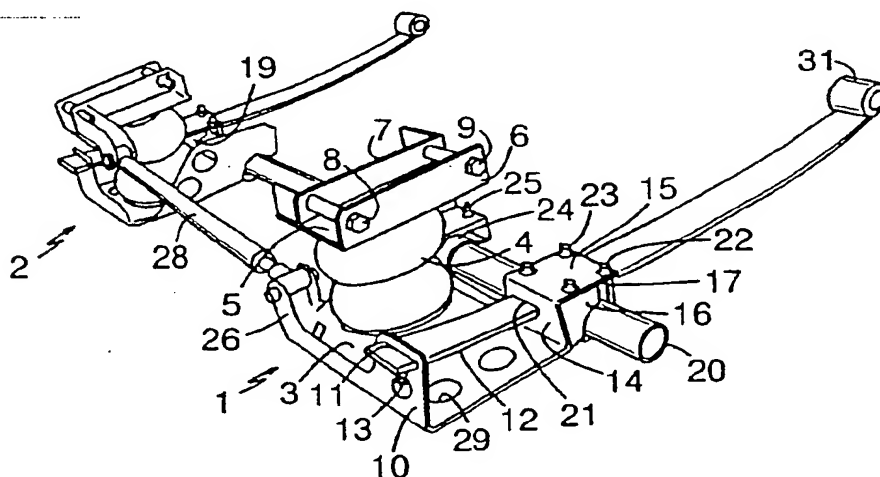




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(54) Title: WHEEL SUSPENSION DEVICE



(57) Abstract

This invention relates to a method of mounting an air spring suspension in a vehicle provided with wheels which are suspended by one or several leaf springs, the air spring suspension comprising a wheel suspension means for each wheel, and the wheels being connected by a wheel axle. According to the invention the method is characterized by the combination of the following steps: the rear part of the leaf spring/leaf springs (12) is cut away at a distance from the wheel axle (20) and behind this one; the wheel suspension means (1, 2; 32, 33) is threaded onto the leaf spring/leaf springs (12) and is brought to a contact against the wheel axle (20); the wheel suspension means (1, 2; 32, 33) is locked against the leaf spring/leaf springs (12) and the wheel axle (20); the wheel suspension means (1, 2; 32, 33) is fastened to the chassis of the vehicle. The invention also relates to a wheel suspension means and a wheel suspension device which are usable for carrying out the method.

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WHEEL SUSPENSION DEVICE

This invention relates to a wheel suspension device for vehicles, preferably light lorries and small buses.

There have lately arisen desires that vehicles, preferably small buses, shall be provided with air spring suspension. The great advantage with such an arrangement, besides the fact that it gives a better riding comfort, is that the air can be evacuated from the air bellows, resulting in that the belly clearance of the vehicle can be reduced. This fact in its turn leads to that the stepping into and out of the vehicle, for instance a bus, is facilitated. This is of course particularly advantageous in a bus which is intended to transport handicapped people. This type of buses is today provided with expensive and heavy lifting devices at the rear part of the vehicle.

This invention relates to a new type of air spring suspension which is very simple regarding the construction and therefore becomes non-expensive, relatively spoken, to manufacture. Another important advantage with this new invention is that it can simply be applied on existing vehicles which are already on the roads, and on which the rear wheels are suspended by means of leaf springs. This known wheel suspension system is common today for instance in small buses and light goods vehicles.

Two preferred embodiments of the invention shall be described more closely below with reference to the accompanying drawings, where Fig 1 shows a perspective view obliquely from behind of a first embodiment of the new wheel suspension device, which is intended for the rear wheels of a vehicle, Fig 2 shows a close-up view of the right part of the wheel suspension device according to fig 1, Fig 3 shows a close-up view of the left part of the wheel suspension device according to fig 1, Fig 4 shows a view from the front and obliquely from above of a second embodiment of the new wheel suspension device, and Fig 5 shows a view from behind of the wheel suspension device according to fig 4.

Referring to figs 1-3 is shown there the first embodiment of the new wheel suspension device. This one comprises two wheel suspension means 1, 2 each of which being intended for a wheel of a vehicle, preferably the rear part of a light lorry or a small bus.

Each wheel suspension means 1, 2 comprises an underlying plate 3, on the top side of which the lower part of an air bellows 4 is fastened. The upper part of the air bellows 4 is fastened on the underside of another plate 5. This plate 5 is provided with two parallel flanges 6, 7, which project upwards and are intended to extend in the longitudinal direction of the vehicle. The distance between the flanges 6, 7 is adapted to the

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width of the longitudinal side frame member of the vehicle, so that the flanges 6, 7 are applied on each side of the frame member when the wheel suspension means 1, 2 is applied on the vehicle. The plate 5 provided with the flanges is kept in place on the frame member by two bolts 8, 9 which penetrate the two flanges and the frame member. The first plate 3 is provided with an upwards projecting flange 10 at its rear part at an area which when applying the wheel suspension means is intended to be outside the air bellows 4. In the upper portion of the flange 10 is made a horizontal, oblong hole 11 which is intended for the rear part of a leaf spring 12 or the like. Instead of a leaf spring it would be possible to have a leaf spring-like bar. The leaf spring 12 is suitably fastened to the flange 10 by means of a bolt 13. Due to that fact is made possible a safe fastening of the leaf spring in the wheel suspension means.

The fore part of the plate 3 at the area outside the bellows 4 is provided with an upwards projecting flange 14. In the upper part of this flange 14 there is a plate 15 which projects forwards and which is essentially horizontal in the mounting position. On each side of the flange 14 between its vertical edge portion 16 and the side edge portion 17 of the plate 15 there is a projecting portion 18, 19. The purpose of these portions is that they shall function as contact supports for a wheel axle 20 of the rear wheels of the vehicle. Furthermore, the flange 14 in the same way as the flange 10 is provided with a horizontal, oblong hole 21 at the area just below the plate 15, through which the leaf spring 12 is intended to be inserted. The portions 18, 19 function in this position as side supports for the leaf spring 12. The leaf spring 12 and the wheel axle 20 are kept fastened on the wheel suspension means 1, 2 by a screw joint. The screw joint comprises two U-formed screw means 22, 23 which surrounds the wheel axle 20 and goes through the plate 15. The fore part of the plate 3 at the area inside the bellows 4 is provided with a further portion 24, which projects upwards. This portion cooperates with a further U-formed screw means 25 for holding a portion of the rear axle positioned inside that portion of the rear axle which is surrounded by the screw means 22, 23. The screw means 22, 23, 25 and the cooperation with the plate 15 result in that the leaf spring 12 as well as the wheel axle 20 become extremely safely fastened to the two wheel suspension means.

According to this embodiment the rear part of the plate 3 of the right wheel suspension means 1 at the area inside the bellows 4 is provided with a portion 26, which projects upwards, and the rear part of the plate 5 of the left wheel suspension means 2 at the area inside the bellows 4 is provided with a portion 27, which projects downwards. At these two portions 26, 27 each of the two ends of a bar 28 is articulately fastened. Thus,

the bar 28 connects the wheel suspension means 1, 2 with each other and functions as a stabilizer.

As is apparent from the drawing the plate 3 with the upwards projecting portions 10, 24 is provided with lightening holes (see for instance the hole 29) in order that the weight shall be kept at a low level. Moreover, the purpose of the holes of the horizontal part of the plate 3 is to lead away dirty water. As is most evidently apparent from fig 3 a valve means 30 is arranged on the top side of the plate 5. By this valve means, air can be evacuated from and be pumped into the air bellows 4.

As has been mentioned previously an important advantage with this invention is that it makes possible a mounting of air spring suspension not only in new vehicles but also in used vehicles, the rear wheels of which are suspended by means of leaf springs. Such a mounting shall be described hereinafter.

The work starts with the fact that the rear part of the existing leaf spring 12 is cut away, whereby the fore part of the leaf spring with its suspension means 31 remains, which means 31 is articulately arranged. The wheel means 1 is applied on the leaf spring 12 in that way that the rear part of the leaf spring 12 is brought through the hole 11 of the flange 10 and the hole 21 of the flange 14. In this position the wheel suspension means 1, 2 is hanging on the leaf spring 12, side support being received from the portions 18, 19. Then the wheel suspension means is brought forwards so far that the portions 18, 19 of the plate 3 comes into contact with the rear axle 20 of the vehicle. Thereafter the leaf spring 12 and the rear axle 20 are fastened by means of the plate 15 and the screw means 22, 23. Furthermore, the leaf spring 12 is fastened to the upwards projecting flange 10 at the hole 11 by means of the bolt 13, and the rear axle 20 is further secured to the plate 3 by the screw means 25. Thereafter the plate 5 with the flanges 6, 7 are fastened to the frame member of the vehicle by screws. Finally, the bar 28 is applied to the two wheel suspension means for connecting of these ones together. The screw means 22, 23 and 25 preferably comprise the original clamps of the vehicle.

In figs 4 and 5 is shown a second embodiment of the invention, intended to be used on another type of lorry/bus and the one for which the first embodiment is intended. This second embodiment is principally built up in the same way as the one previously described. Accordingly, it comprises two separate wheel suspension means 32, 33, each one of which having an air bellows 34, 35, and which are connected to each other by a stabilizing bar 36. In using position and outside each one of the air bellows 34, 35 there is arranged a means 37, 38, through which the leaf spring of the vehicle is intended to be

inserted and then fastened to the means by the bolts 39. Inside and in using position in front of the air bellows 34, 35 there are means 40, 41 by which the device according to the invention is fastened on the rear wheel axle of the vehicle. Also the fore parts of the means 37, 38 can be utilized for holding the device on the wheel axle. In such a case, it
5 would be suitable to let these fore parts cooperate with for instance U-formed bolts.

Furthermore, the device above each air bellows 34, 35 is provided with further means 42, 43 by which the device according to the invention can be fastened to the longitudinal frame members of the vehicle.

The feature that principally differs this embodiment from the first described one
10 is the presence of a transverse girder 44, which connects the two wheel suspension means 32, 33 with each other, and which is fastened to two plates 45, 46 which constitute the upper supporting surface of respective air bellows. These mentioned plates 45, 46 can with advantage also function like those means 42, 43 by which the device according to the invention is fastened to the frame members of the vehicle. For the sake of clearness the
15 lower supporting surface (plate) of the one air bellows 34 is indicated with the numeral 47.

The great advantage with this second embodiment is that the wheel suspension becomes more stable. Stability becomes extra good by the fact that the respective end of the girder 44 is fastened to the same plate 45, 46 that constitutes the upper supporting
20 surface of respective air bellows. Thus, this wheel suspension device is better adapted for the somewhat heavier vehicles.

The invention is of course not limited to the mentioned and shown embodiments but can be modified within the scope of the following claims.

Claims

1. A method of mounting an air spring suspension in a vehicle provided with wheels which are suspended by one or more leaf springs, the air spring suspension comprising a wheel suspension means for each wheel and the wheels being connected by a wheel axle, characterized by the combination of the following steps:
- The rear part of the leaf spring/leaf springs (12) is cut away at a distance from the wheel axle (20) and behind this one;
 - The wheel suspension means (1, 2; 32, 33) is threaded onto the leaf spring/leaf springs (12) and is brought to a contact against the wheel axle (20);
 - The wheel suspension means (1, 2; 32, 33) is locked against the leaf spring/leaf springs (12) and the wheel axle (20);
 - The wheel suspension means (1, 2; 32, 33) is fastened to the chassis of the vehicle.
2. A wheel suspension means for vehicles, usable for carrying out the method according to claim 1, characterized by the combination of the following features:
- It comprises an air bellows (4; 34) which is active between two plates, which are essentially horizontal in a mounting position and constitute a lower plate (3; 47) and an upper plate (5; 45);
 - The lower plate (3; 47) has a first means (10; 37) which in using position is placed outside the air bellows (4; 34) and which has such a design that it can be inserted onto the end of a leaf spring (12) or a similar plate-formed bar and be locked in relation to the leaf spring/bar which is intended to be fastened in the chassis of the vehicle at its fore end (31);
 - The lower plate (3; 47) has a second means (15, 18, 19; 40) by which the wheel suspension means is intended to be fastened on a wheel axle (20) on that vehicle the wheel suspension means is intended for;
 - The upper plate (5; 45) has a third means (6, 7; 42) which is intended to cooperate with a frame member in the chassis in the vehicle for locking the mentioned plate to the chassis.
3. A wheel suspension means according to claim 2, characterized in that the first means (10; 37) has an oblong opening (11), which extends horizontally in using position and which is intended to be penetrated by the leaf spring (12)/bar, and that the first means (10; 37) comprises a screw means (13; 39) which is intended to engage the

leaf spring/the bar in the opening (11) for locking the same.

4. A wheel suspension means according to claim 3, characterized in that it has a fourth means (14) in the form of an upwards projecting flange, which in the using position is placed straight in front of the first means (10), that in the upper part of the flange (14) there is arranged a plate (15) which is essentially horizontal in the mounting position and which projects forwards, that on each side of the flange (14) between its vertical edge portion (16) and the side edge portion (17) of the plate (15) there is arranged a projecting portion (18, 19) which function as a support for the wheel axle (20), and that the flange (14) at its top part is provided an oblong opening (21), which extends horizontally and which is intended to be penetrated by the leaf spring (12)/the bar.

5. A wheel suspension means according to any one of the claims 2-4, characterized in that a valve means (30) in connection with the air bellows (4) is arranged on the top side of the upper plate (5), whereby air can be evacuated from or be pumped into the air bellows (4).

6. A wheel suspension device comprising two wheel suspension means according to any one of the claims 2-5, the one means (1) being intended for suspending a first wheel on the one side of the vehicle and the second means (2) being intended for suspending a second wheel on the other side of the vehicle, characterized by the combination of the following features:

- The lower plate (3) of the first wheel suspension means (1) has a portion (26), which projects upwards and is positioned behind and inside the air bellows (4) in the mounting position;

- The upper plate (5) of the second wheel suspension means has a portion (27), which projects downwards and is positioned behind and inside the air bellows (4) in the mounting position;

- Each end of a stabilizing bar (28) is articulately connected with respective mentioned portion (26, 27), whereby the two wheel suspension means (1, 2) are connected with each other by the mentioned bar.

7. A wheel suspension device comprising two wheel suspension means according to any one of the claims 2-5, the one means (32) being intended for suspending a first wheel on the one side of the vehicle and the second means (33) being intended for suspending a second wheel on the other side of the vehicle, characterized in that it has a transverse girder (44) which connects the two wheel suspension means (32, 33) with each other, and that it is fastened on the top side of respective upper plate (45, 46) of

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each wheel suspension means.

8. A wheel suspension device according to claim 7, c h a r a c t e r i z e d in that a stabilizing bar (36) connects the one wheel suspension means (32) with a portion of the girder (44) which is positioned in the proximity of the second wheel suspension means
5 (33).

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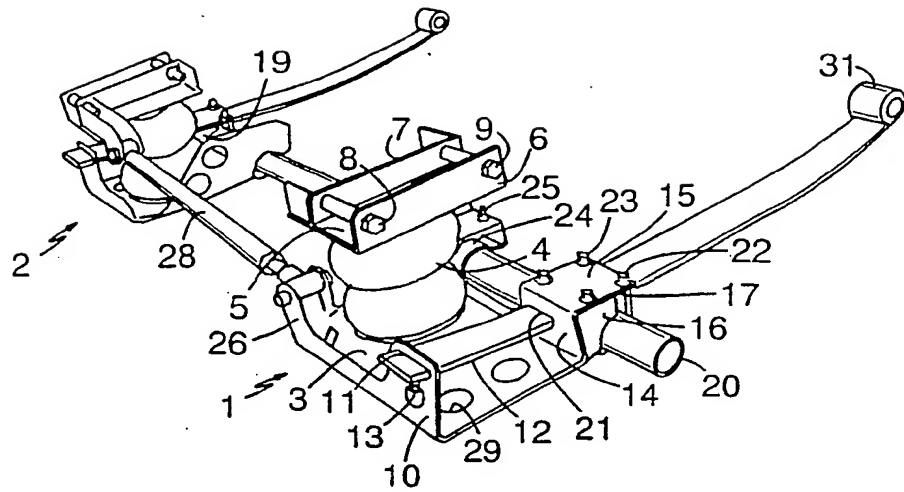


FIG.1

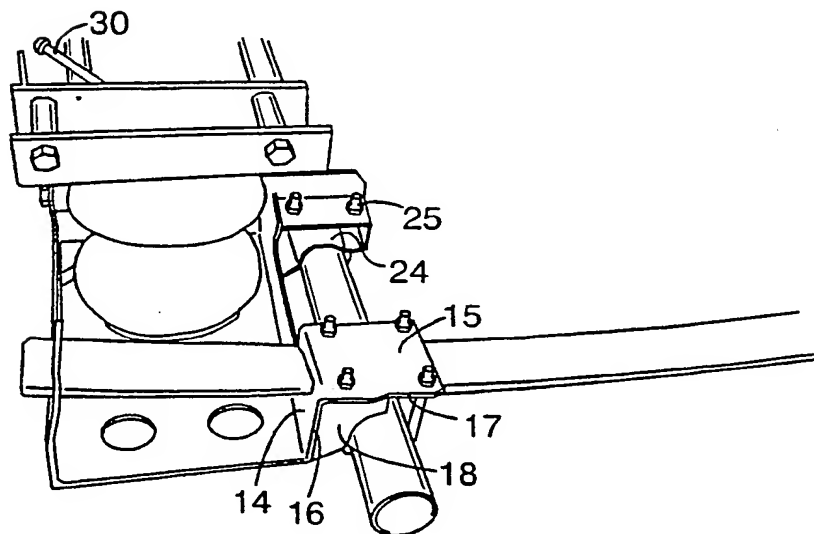


FIG.2

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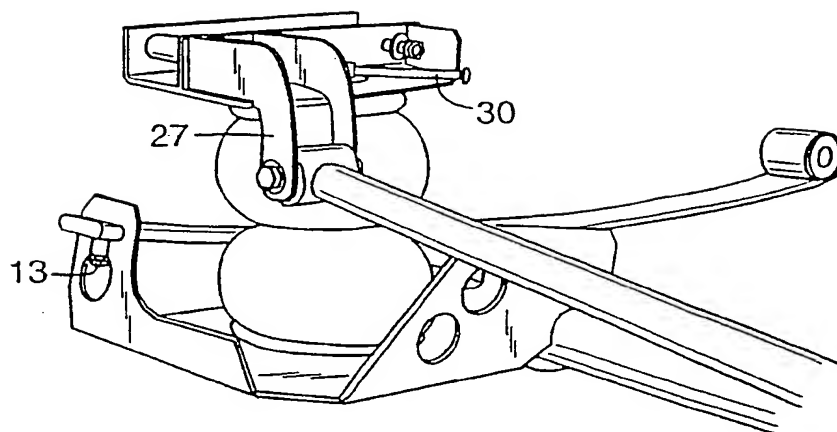


FIG. 3

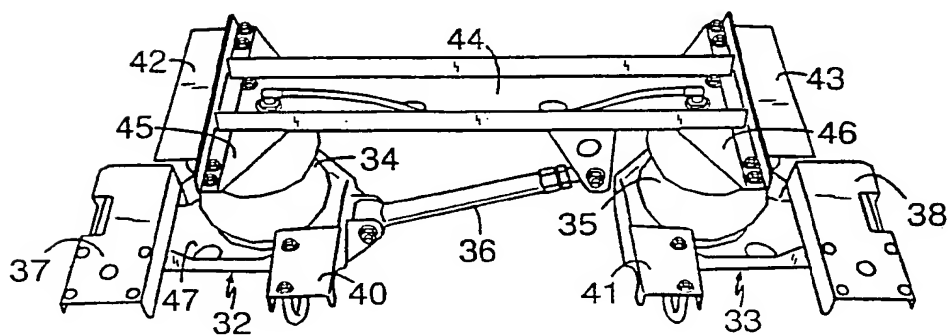


FIG. 4

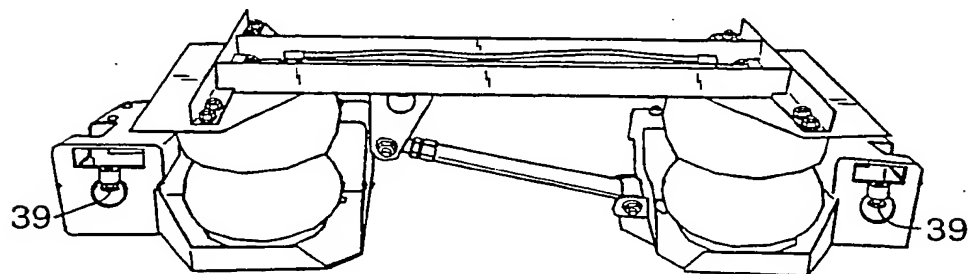


FIG. 5

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INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER

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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 3390895 (S.C. VERDI), 2 July 1968 (02.07.68), column 2, line 48 - line 54; column 3, line 3 - line 10, figures 2,3 --	2,5
X	US, A, 3361445 (H.C. HARBERS), 2 January 1968 (02.01.68), column 3, line 52 - line 68, figure 1 --	2
X	US, A, 3434707 (J.E. RAIDEL), 25 March 1969 (25.03.69), column 2, line 40 - line 55, figure 1 --	2

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Date of the actual completion of the international search

28 November 1994

Date of mailing of the international search report

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 3510149 (J.E. RAIDEL), 5 May 1970 (05.05.70), column 2, line 20 - line 30 -----	2

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US-A-	3390895	02/07/68	NONE	
US-A-	3361445	02/01/68	NONE	
US-A-	3434707	25/03/69	NONE	
US-A-	3510149	05/05/70	NONE	

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